Zero Retries issue 0207 2025-06-20

Zero Retries is an independent newsletter promoting technological innovation in and adjacent to Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2800+ subscribers.

About Zero Retries

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Substack says “Too long for email”? **YES**

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Paid Subscribers Update

My thanks to **Scott Honaker N7SS** for *renewing* as an **Annual Paid Subscriber** to Zero Retries this past week!

My thanks to **Chuck Till, K4RGN** for *upgrading* from a free subscriber to Zero Retries to an **Annual Paid Subscriber** this past week! K4RGN included this nice note:

> *ZR is a great source of leading-edge info. I remember Don Lancaster and Popular Electronics!*

Financial support from Zero Retries readers is a significant vote of support for the continued

publication of Zero Retries.

# # #

Directory of Independent Open Amateur Radio Technical Media

I've wanted to have an easy reference to other regularly updated media that discuss technical topics at least adjacent to Amateur Radio that are published "in the open". In fairness, all of those terms are entirely self-defined by me.

That small writing / web project has been a persistent, nagging "I really need to *do* this to get it out of my *easy things to do*" queue.

Now the initial version is *done*, and now it's *easy* to add to, update, and most importantly, offer a consistent reference to this information for my fellow Independent Open Amateur Radio Technical Media providers.

# # #

UALR Callsign Server is *Back!*

When mentioning Amateur Radio Operators in Zero Retries, I observe a minor formality of the first mention includes their *full* name and *then* callsign. Thus I end up looking up a lot of callsigns to find a surname. My absolute favorite callsign lookup service used to be a provided by the University of Arkansas at Little Rock (UALR) Amateur Radio club, managed by Keith Hudson N5EEZ. Using that site was muscle memory: callsign.ualr.edu. Years ago, due to unfortunate issues with its server being disconnected, it went offline. I was in mourning, and kept in touch with N5EEZ for months hoping it could be brought back. All indications were that UALR Callsign Lookup had gone offline for good.

Since then, I had been suffering from doing callsign lookups on a really irritating service that required me to log in… irritatingly often, with a very clunky user interface.

But purely out of nostalgia I decided to look up UALR Callsign Server solely to be able to reference my former favorite callsign lookup being no more… and to my astonishment, *it was back!* And greatly improved!

https://callsign.wa5lru.org/search.php

Browsing around a bit, I found this passing mention:

> **callsign.ualr.edu has moved**
>
> Posted on April 20, 2024 By KF5LNM
>
> We have brought the old callsign.ualr.edu server back as callsign.wa5lru.org and added GMRS and some extra information from external APIs.
>
> https://callsign.wa5lru.org/

> UALR IT Services has updated DNS for callsign.ualr.edu to point to this new address.

Thanks to a nice article by Anthony Good K3NG (Radio Artisan blog), I now know about a few other nice, fast, streamlined callsign lookup services on the web. Scroll down a bit to:

> You might want to try using these fine sites for callsign lookups:

Of those services listed, I was impressed with:

- https://www.hamdb.org
- https://www.hamqth.com
- https://callook.info

# # #

New Edition of FreePascal From Square One

Not specific to Amateur Radio… but hey, sometimes I take advantage that it's my own quirky little newsletter.

Jeff Duntemann K7JPD on his Jeff Duntemann's Contrapositive Diary blog:

> *FreePascal from Square One* really is a free ebook. It's a distillation of the four editions of my Pascal tutorial, *Complete Turbo Pascal*, which first appeared in 1985 and culminated in *Borland Pascal 7 From Square One* in 1993. I sold a lot of those books and made plenty of money, so I'm now giving it away, in hopes of drawing more people into the Pascal universe.

Of all the programming languages I've dabbled with, the only two that ever made any sense for my text-centric brain were BASIC and Pascal. And, in my youth, I could actually grok some Assembly Language programming (but that mental agility is long dissipated).

One of the reasons K7JPD's new book is relevant to me is that FreePascal can be installed and run on Raspberry Pi computers. Thus I can imagine (fantasize, really) about one of these years, programming in Pascal (perhaps with a little help from an AI) to run my own unique software on RPi computers.

# # #

Weekends Are For Amateur Radio!

As for the activities that I listed in Zero Retries 0206, I did get a few of them done, but I really enjoyed my weekend, which was the most important part.

Have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

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The TPRFN Network: Could be a Lifeline in Times of Emergency

By Glenn R Allison N3MEL

In an increasingly interconnected world, our reliance on commercial communication networks—cellular, internet, and landlines—is undeniable. However, when disasters strike, these very systems are often the first to fail, leaving communities isolated and emergency responders struggling to coordinate. This is where the ***Packet Radio RF Forwarding Network (TPRFN)*** *steps in, offering a vital and resilient communication backbone that could prove to be a true lifesaver during emergencies.*

TPRFN is a network built upon **amateur radio (ham radio) packet radio technology**. Unlike commercial networks that depend on extensive and often vulnerable infrastructure, ham radio operates on independent frequencies and can be maintained with minimal power requirements and portable equipment. The core mission of TPRFN is to **rebuild and enhance the RF (Radio Frequency) packet radio backbone across the United States**, creating a robust and redundant system for data communication.

Why TPRFN is Crucial in Emergencies:

- **Resilience Against Infrastructure Failure:** When cell towers are toppled, power grids are down, or internet cables are severed, commercial communication becomes impossible. TPRFN, relying on decentralized amateur radio stations with battery or solar power backups, can continue to operate. This makes it an indispensable tool for maintaining communication when traditional systems fail.

- **Data Communication Capabilities:** Beyond voice communication, packet radio allows for the transmission of data. This means that during an emergency, responders can send and receive text messages, forms, incident reports, and even small files. This is critical for conveying detailed information, coordinating resources, and maintaining situational awareness.

- **Off-Grid Operation:** Many TPRFN nodes are designed to operate independently of the commercial power grid. Equipped with solar panels, generators, and battery banks, these stations can remain operational for extended periods, providing a persistent communication channel even in prolonged outages.

- **Interoperability and Coordination:** Amateur radio operators, often organized into groups like the Amateur Radio Emergency Service (ARES) and Radio Amateur Civil Emergency Service (RACES), are trained in emergency communication protocols. The TPRFN facilitates an organized monthly "net" where information can be systematically collected, relayed, and distributed across the network and to various agencies as needed.

- **Bridging Communication Gaps:** Natural disasters can create communication "dead zones." The TPRFN, through its strategically placed Hub & Polling Stations, can extend communication ranges and bridge these gaps, ensuring that even remote or isolated areas can maintain contact with incident command centers.

How it Works:

- The TPRFN leverages various digital modes, including **AX.25 Packet, HF & FM VARA, ARDOP, and AREDN**. These technologies enable data to be transmitted reliably over radio waves, often through a series of "hubs" that forward the information across the network. This distributed architecture means that even if some nodes are offline, the network can reroute traffic, further enhancing its resilience.

- Why Packet Radio, 1**. Interoperability** with Multiple Systems: Packet Radio can interface with other digital systems, including email, SMS, and internet gateways. This flexibility is vital for emergency communications where different organizations and technologies must work together seamlessly. Standard Protocols: It uses standardized protocols like AX.25, ensuring that equipment from different manufacturers can communicate, which is essential when coordinating between various emergency response teams. 2. Network Flexibility **Ad-Hoc Networking**: Packet Radio networks can be set up quickly and operates peer-to-peer within the TPRFN Network, allowing for flexible network topologies. This adaptability is critical in rapidly changing disaster environments.

- Winlink, although we believe in the concept of this valuable service and most network Hub Stations offer Remote Message Service (RMS) as well as APRS SMS & Email services (more on Winlink below). Additional we are watching the development of the **IP400 Mesh:** https://adrcs.org/adrcs/ip400-network-project/

- The network operates in a **Near Vertical Incidence Skywave (NVIS)** configuration on HF which allow for data transfer even in the worst of band conditions such as the solar storms we have been experiencing. TPRFN also leverages VARAHF which has the ability to connect and move the data when other modes can't. With VARAHF we also have error correction so when the message arrives at its destination it is complete.

- For example, during a widespread power outage, a remote EMCOMM team could use a packet radio terminal to send a message requesting specific supplies or reporting on the number patients, which would then be relayed through the TPRFN to an emergency operations center. Similarly, evacuation orders or public safety announcements could be disseminated to affected areas.

- TPRFN's strength is to those portable ad-hoc HF stations that may be needed after a local or regional event (like Hurricane Helene in NC) although the network did not see much activity, we continue to be ready and on the air 24/7.

- How can you help? TPRFN Hub and Polling Stations currently consist of individual Amateur Radio Operators and their stations, but Amateur Radio HF stations operated by groups such as Amateur Radio clubs or Emergency Communications organizations are welcome to participate in TPRFN. The TPRFN Network is continually looking for

additional stations across the country to serve as either a (full time) Hub Station or a (part time) Polling Station using VARAHF.

- The network offers assistance with setting up a network station or just an end user station that will allow you access to the Packet network as well as Winlink RMS, these instructions can be found on our website @ www.tprfn.net or if you need additional assistance we also offer the following:

Contact Us Form: https://www.tprfn.net/contact-us

Groups.io: https://groups.io/g/Packet-Radio-RF-Forwarding

Facebook: http://www.facebook.com/groups/rfpacket/

- The network also holds a monthly net, **The Packet Radio Bulletin Net or PKTNET**. The purpose is to continually check radio circuits across the US and to engage and encourage operators to practice their skills passing digital traffic.

TPRFN Partners:

- **Delaware Packet Network** https://www.depn.net/
- **Eastnet Packet Radio Group** https://www.qsl.net/ww2bsa/eastnetpackethome.htm
- **AuxCom USA** https://www.tprfn.net/network-emcomm-partners
- **RRI Radio Relay International** https://www.tprfn.net/network-emcomm-partners
- **PR Digital** (in Puerto Rico) https://www.tprfn.net/pr-digital

The Future of Emergency Communications:

While commercial networks are constantly improving their resilience, the inherent vulnerabilities of centralized infrastructure will always exist. The TPRFN, by building a decentralized and robust communication network, provides a critical layer of redundancy and a vital alternative when all else fails. As more amateur radio operators contribute to the expansion and maintenance of the TPRFN, its capacity to serve as a reliable lifeline in times of emergency will only grow, strengthening community resilience and improving disaster response capabilities across the nation.

For Additional Network Information:

See us on our website at www.tprfn.net

Winlink and TPRFN

As mentioned earlier Winlink offers a very useful platform to the Amateur Community and like all the other digital platforms it has its limitations. The overwhelming dependency on the internet is by far the main reason that TPRFN went with the proven AX.25 Packet Radio technology. TPRFN does recognize the importance of the Winlink Network and is why we offer

it as an additional network service!

Thank you to the reviewers of this article:
Tom Costello KC3TMT
Steve Stroh N8GNJ

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Oh, The Signals You'll Make

By Steve Stroh N8GNJ

*(With apologies to the wonderful book **Oh, The Places You'll Go** by Dr. Seuss.) Amateur Radio has a tendency to make the mistake of "Oh, **that's** not possible" because most folks don't take into account the technologies of **this** era, such as the ~~potential~~ current capabilities of Software Defined Radio technology.*

I'm regularly amused by the "oh, *that* can't be done" mindset, especially by those who develop radio technology. Many examples leap to mind of designers of radio technology not imagining that radio technology would ever advance to the point where a simplistic type of security would be compromised… and yet radio controlled garage door openers were compromised by kids riding around on their bicycles pressing a garage door opener to see which garage door openers used the same simplistic code as the one in their hand. A major city's emergency siren system was activated by a hacker who apparently just monitored the spectrum, found the activation frequency and sequence to activate it, recorded it and played it back. Some cars could once be easily unlocked with the same technique - record "chip keys" transmissions, and play them back.

I won't rehash my arguments about our arcane and *grounded in 20th century radio technology* regulations… not just for Amateur Radio, but also for other portions of spectrum regulated by the FCC. That's out of scope for the idea I'm trying to present here.

Amateur Radio writ large suffers from *a lack of imagination about what's possible* with radio technology in the present. A case in point of the moment is the potential for the technology being developed in the IP400 Network Project to *only* be usable in the 420/430-450 MHz band. That's true *at this moment*, while the project is in the development stages, based on specific chipsets that only operate on the 420/430-450 MHz band.

But positing that IP400 will only be usable on the 420/430-450 MHz band, or perhaps the 902-928 MHz band or the 1240-1300 MHz band where there's 28+ MHz of spectrum allocated in each of those bands for Amateur Radio operation (for the moment), ignores the rise of other types of radio technology…

Such as Software Defined Radio. Literally, it's all there in the name - ***Radio*** technology… ***Defined by Software***.

Consider, for example, the RedWire Technologies1 Oxygen Software Defined Radio. This particular unit is to actually be used as a radio… not a piece of laboratory equipment. By Amateur Radio standards, it's expensive2. But as we know, all digital technologies tend to simultaneously become more capable and less expensive over time3, thus Oxygen is a reasonable example to use for this discussion. Oxygen operates from 70 MHz to 6 GHz… under software control. Oxygen has some hardware constraints, such as its lower frequency limit of 70 MHz, and low transmit power (that is typical for Software Defined transceivers). But *within those constraints* of the hardware, *nearly any radio technology* can be implemented, if a radio technology can be described in software, such as implementing it in the GNU Radio software framework.

Thus once IP400 is fully functional, a specification can be developed for its operation, and (this is a *it's **going** to **happen*** prediction) soon afterwards, IP400 will be "ported" to GNU Radio. And at that point, an Oxygen, or equivalent, can be instructed (again *in software*) to operate an IP400 signal in whatever spectrum one chooses (and can legally transmit in), such as the Amateur Radio (US) 222-225 MHz, or 144-148 MHz, or 50-54 MHz bands (with a unit other than Oxygen, or with the addition of an adapter or transverter). Admittedly it might be a "tight fit" to operate a 50 kHz, or 100 kHz, or even wider bandwidth signal in the Amateur Radio VHF bands… but the point I'm making here is *that it is doable*. For example, I doubt that there's much Amateur Radio activity in the middle of Montana, or Alberta, that would prevent a future derivative of IP400 (imaginary name) "IP222" from being used.

More importantly, such a technology advance is completely foreseeable with the *technology of the moment*. Such technology is not only doable but likely and inexpensive with a reasonable extrapolation of near term improvements of Software Defined Radio technology such as Oxygen.

We already have Software Defined Receivers *so cheap that they can be dedicated to particular uses*, such as building a SatNOGS satellite receiver station. And to answer a common plaint that typical, inexpensive Software Defined Receivers are both too broadband (can be "overwhelmed" by nearby high power broadcast transmitters) and not very sensitive, those limitations are easily overcome with inexpensive bandpass filters for the band of interest, and preamplifiers that can boost the receive signal remotely near the antenna. I speak from direct experience, having purchased both such units from Halibut Electronics.

Amateur Radio does not suffer from a lack of capabilities. In my perspective, the most significant failing of Amateur Radio in the 21st century is our lack of imagination to fully utilize *all the capabilities we have available*.

Leave a comment

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Amateur Radio's Lack of Imagination About Repeater Technology

By Steve Stroh N8GNJ

Several recent developments in Amateur Radio repeaters illustrate Amateur Radio's collective

lack of imagination about what's possible with 21st century repeater technology. But… that "nothing new happening with repeaters" mindset is about to get disrupted.

I'm certainly not the only one to observe that many… *most?* repeaters are "going quiet". When I've brought up this observation… I've yet to be challenged about it. I think any of us who monitor repeaters have observed this trend - few conversations on repeaters, with only a small fraction of the available airtime in use on any particular repeater.

In previous issues of Zero Retries, I've proposed that a "quiet repeaters" could be repurposed to carry data communications as well as voice, but that particular discussion is out of scope for this article.

Admittedly there are many repeaters that *are* active… but a significant portion of that activity is that repeaters are being linked, and thus many repeaters are merely "parroting" what is occurring on other repeaters… or Internet talk groups. In other words, many… most? repeaters aren't actually being used locally as intended - repeating local transmissions received on the repeater's input frequency and retransmitted on the repeater's output frequency.

Despite that there are ample repeaters already available, and also ample "repeater airtime" available, there seems to be steady demand to put up even more repeaters. This is understandable for areas that are actually underserved, such as rural areas. For example, in my lifetime, there has never been an Amateur Radio repeater built in my hometown of Port Clinton, Ohio despite it being the Ottawa County seat and the presence of somewhere between 50 and 100 Amateur Radio Operators in the 43452 ZIP code.

I've also made the case that there should be "tactical, targeted" repeaters (for both data and voice) for specific use cases, such as near colleges to support potential use by students, or large housing complexes to encourage use by portable radio users, etc.

To "make room for more repeaters" (of which I guess I'm complicit to some degree - see above), I guess it's somewhat understandable that there's some movement to follow the "narrowband" frenzy that was mandated by the FCC for commercial two way radio users and spectrum to "create more repeater channels" in the "limited" spectrum in the Amateur Radio VHF / UHF bands generally agreed upon for use by repeaters.

One of the organizations advocating for Amateur Radio "narrowbanding" is the Western Washington Amateur Relay Association (WWARA). The WWARA's "narrowbanding initiative" was elevated to wide discussion outside Washington by Gary Pearce K4AAQ, co-host of the HamRadioNow in a QRZ Forum article - Narrow FM, Anyone? HamRadioNow Episode 544, which highlighted the HamRadioNow HRN 544: Narrow FM, Anyone?

I confess I haven't watched the episode because I'm not sympathetic to the WWARA's arguments that the "lack of repeater channels" constitutes a significant situation that needs to be micromanaged into "requiring" a reorganization of the portions of spectrum generally agreed upon for repeater operation in Western Washington.

In my opinion, the WWARA's manual ~~coordination~~ micromanagement of the portions of spectrum generally agreed upon for repeater operation is a process that's state of the art - for the 1970s. That is, it's an entirely manual process. In my opinion, the only significant change that

I've observed in the WWARA's process that has been updated from the 1970s is that WWARA now publishes their directory of "coordinated" repeaters online instead of on paper.

In my opinion, now that we have the Internet, and thus all parties that want to operate a repeater in Amateur Radio spectrum can make use of a wiki or email list to post notice of their repeater's operation, with contact information, and then repeater operators can sort out any resulting issues *directly amongst themselves*.

And the majority of the comments in the K4AAQ QRZ Forum article, which admittedly I have only skimmed, don't seem to agree with WWARA's approach. Selected examples:

> Type "silent ham radio repeaters" into your search engine and explain to me why it's a good idea to spend the money to make these "silent repeaters" narrow FM.
> **K3XR**
>
> Yeah narrow banding is needed because there's hardly a day that goes by where I can find a clear frequency to use on the busy, jammed packed 2m band.... (/Sarc)
> **KC8VWM**
>
> When machines sit idle most the day I see no reason a second machine cannot co-exist on the same pair with a different tone. Just [be] aware [of] their coordination complaint privilege. Some more SNP (shared non protected) pairs for lower profile/lower power machines are in order.
> **KB9MWR**

There are seven pages of comments.

Another objection I have about "narrowbanding" is that I feel that we're on the cusp of a renaissance of repeater technology to allow data communications over repeaters, and 25 kHz repeater channels, versus 12.5 kHz repeater channels, will allow for faster data communications.

But enough about the WWARA and their worldview… which is about to be completely disrupted by technology - read on below.

Time Division Duplex (TDD) Single Frequency Repeater (SFR)

I first mentioned the possibility of Time Division Duplex (TDD) Single Frequency Repeaters (SFR) (also called Simplex Repeaters) in **Zero Retries 0205** - Thorough Explanation of Single Frequency Digital Mobile Radio Repeater. That article explained that TDD SFRs are now possible.

I did a followup article in **Zero Retries 0206** - Followup On Single Frequency Repeaters.

But I had no idea that TDD SFRs *are now becoming widely available*, such as these three repeater units:

- Rexon DMR Digital Direct Mode (TX = RX Same Frequency) Repeater

- Klein FLEX VHF/UHF 10W Single Frequency Digital Repeater
- Retevis RT74 Full Duplex and Single Frequency DMR Repeater

I didn't attempt a study to find other such units. If one Chinese radio company such as Retevis has discovered this lucrative niche (supporting a price point of nearly $1000), there will soon be *many more such units available*.

These repeaters can operate as a full duplex repeater on a single VHF / UHF channel. Given that these units do not require a "repeater pair", it's questionable whether the operation of of such units falls within the scope of organizations such as the WWARA that coordinate the limited number of "repeater ***pairs***".

But if you think these two repeater units are *disruptive to Amateur Radio repeater operation and coordination*… you ain't see nuthin' yet.

Retevis Ailunce H1, image courtesy of Retevis (cropped screenshot)

Retevis Ailunce H1 DMR Radio

I was unaware of this unit until alerted to it by Charles Hargrove N2NOV - my Thanks!

Retevis Ailunce H1 DMR Radio which incorporates Single Frequency Repeater capability.

The web page for this also calls this feature *Same-frequency Relay*.

> The Ailunce H1 DMR walkie-talkie with single-frequency technology represents a paradigm shift in two-way communications. Eliminating the need for paired frequencies and bulky infrastructure, the H1 enables users to establish a reliable network anytime, anywhere.

Yep. You read that right. The capability to do TDD SFR will soon be embedded in a *portable* radio.

This capability… just *lapped* all of the other Amateur Radio Digital Voice modes.

Can D-Star radios function as a Full Duplex SFR? *Nope*.

Can System Fusion radios function as a Full Duplex SFR? *Nope*.

Post publication update:

I had originally listed TETRA in the "Nope." with the other three Digital Voice systems below. Apparently that's incorrect, per Werner OE1WRS in the Comments for this issue. See the additional detail there.

> Tetra uses single frequency repeater in DMO mode, we do have a number of Tetra repeaters in OE land (and other countries) which work on one frequency without duplexer etc. those are even networked so when you talk on one in one city you are also heard on the other repeaters in other cities (or on mountains). Most Tetra terminals can act as repeater….

P25? NXDN? M17? *Nope*.

Not to mention, none of those technologies and radios from the respective companies are implemented into a portable radio such as the H1.

Just imagine the possibilities! Now you can put a repeater in dorm room window, or in an apartment complex. Or nearly any high location to be able to provide your co-conspirators with repeater coverage. Or provide ad-hoc repeater coverage at an event.

Most disruptive of all, you can use *any single frequency in 144-148 MHz or 430-450 MHz for full duplex repeater service*. It's an elegant solution to *so many situations*.

Ironically, it's a running joke in Amateur Radio that we'll eventually get to a situation of 1:1 repeaters and Amateur Radio Operators. Now that can nearly be literally true.

Now that… is 21st century repeater technology.

Per this link, the Retevis Ailunce H1 begins shipping 2025-06-20 and the unit cost is $180 plus shipping, minus any discounts.

Now if we could only figure out how to use DMR for data communications without resorting to proprietary data over DMR systems like Motorola's and Hytera's.

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The Wisdom of Seth Godin

Bu Steve Stroh N8GNJ

I doubt that Seth Godin knows about Amateur Radio given that he's pretty busy being a

philosopher for creators, business, and culture. But he's provided many inspirations to me, and his book ***The Practice: Ship creative work*** *provided inspiration to me to have the audacity to imagine that I had something useful to say to Amateur Radio with Zero Retries.*

In addition to his many books, Godin publishes a daily blog post… *every* day, for many years now. I catch up on my reading of Godin's blog , only when I have a quiet period to reflect on and absorb his lessons. Most of Godin's lessons don't resonate with me, such as wisdom for effective managers or contributing meaningfully to society when you feel like a minion in a mega corporation. But regularly, Godin offers wisdom that feels relevant not just to me, but (at least in my mind) to Amateur Radio. Such as:

Ecosystems come and go

> …
>
> We can lament the end of an ecosystem. After all, we worked hard to get here and we counted on it. We're comfortable with it and we understand it.
>
> Or, we can accept that ecosystems come and go, and focus our energy on how the next ecosystem gives us a chance to do our work, new work, different work, but work that matters, for people who care.

Ecosystems… speaks to change in Amateur Radio in many ways - information distribution, the motivations of people becoming Amateur Radio Operators in past eras, the motivations of new Amateur Radio Operators in this era and what they intend to contribute and want to get from being involved in Amateur Radio. Ecosystems especially speaks to Amateur Radio *technical paradigms*. In so many ways, ecosystems that Amateur Radio developed with in the 20th century really don't exist any more. Regulatory limitations, how spectrum is used (hard partitioning - in the 21st century?), hardware radios, data and digital eclipsing voice and analog, etc.

Just the right length

> …
>
> When technology changes the media, when distribution and consumption shift, the definition of just the right length shifts as well. Podcasts changed the length of interviews, LinkedIn changed the length of a resume and YouTube changed the length of funny videos… the cycle continues.

Length… speaks directly to me in publishing Zero Retries as validation that in *this* era, with this era's *tools and capabilities*, one can use as much length, time, and reader attention as one thinks is required to explain a subject. I've tried to contribute to some organization's newsletters and my input was dismissed. I was told "your stuff is *way* too long" because the conventional wisdom of newsletters[4] is that they are supposed to be *short* (and that reader's attention span for text material is limited). With email distribution of newsletters, backed up by web articles, in Zero Retries I'm able to to allocate the time, and space, and reader's attention to explain a topic as thoroughly as I feel is justified. And, *I try to not take too much time and text* to explain something. Really, I *do* edit 😉

I think Godin also speaks to the fallacy of continuing the "print model" of publishing information in this online era. A great example is a contrast of my recent submissions of two articles to two different publications. I submitted a short article (about 500 words) to ARRL's magazine QST. They informed me that due to space limitations, my article won't be in the *print* edition of QST, but it will be included in the *online* version of QST. Imagine the burden, the inefficiencies of maintaining two separate versions of the same content.

In contrast to my experience with QST, I submitted my column for the July / August 2025 issue of Surrey Amateur Radio Communications' The Communicator "newsletterzine", which regularly runs to over 100 pages. When I submitted my column, it was nearly 3000 words… and the editor said "wow", but didn't request that I reduce my column (I offered). That's because The Communicator has fully embraced this era of publishing only online, and thus can accommodate longer content.

Tools and the long tail

> 65,000,000 people have uploaded a video to YouTube. In 1980, there were 8 movie studios actively producing mass market movies.
>
> More than 10,000,000 people have uploaded a song to Spotify… you get the idea.
>
> And now, it changes again. The number of people writing software tools and games is on the very same curve. We're going to go from hundreds of software companies to millions, in just a few years.
>
> Change the tools (and their distribution) and you change the future.

Tools… speaks to several levels of Amateur Radio including widespread content creation such as the plethora of YouTube channels discussing Amateur Radio. But mostly it's a pithy description of something I've been trying to promote in Zero Retries, that the ***tools*** we have available in Amateur Radio (but not exclusive to Amateur Radio) enable ideas, technologies, systems, networks, etc. that previously *we could barely imagine*… as well as things *we* ***could not previously imagine*** in Amateur Radio. The easiest and most prominent example is Software Defined Radio technology. We now have hardware available to us that if one can describe a radio technology in software, that radio is then a reality - just load software onto a Software Defined Transceiver, and voila! ***A new radio!***

I think it's important to step back and recognize *all* the tools we now have available to us in Amateur Radio. For decades now, thanks to the universal availability of the Internet, Amateur Radio has a worldwide pool of potential contributors and collaborators (I enjoy calling them "fellow instigators" and "co-conspirators") to be able to develop Amateur Radio technology. We have "easy" manufacturing capability, as needed. We can form organizations much more easily. We have payment systems that can crowdfund interesting projects and organizations.

Most of all, we now have Artificial Intelligence - AI systems to help us create understand radio technology. Within a few months I will have built my own bounded AI system for all of the four years of Zero Retries thanks to Google's NotebookLM which was specifically designed for such uses.

AI can also be used to create *entirely new radio technologies*, that, again, we could barely, or could not previously imagine. We're watching some of this play out in the Russia / Ukraine war with the need to maintain drone communications in the face of intense jamming. Ukraine and its partners, are creating entirely new types of communications that simply weren't possible even a year ago, because they're creating, applying, and testing new radio technologies and techniques at scale, with little consideration for legacy spectrum partitions, regulatory restrictions, what can be cost effectively mass produced, etc.

One of my favorite examples of old ideas that can be given new life with the radio technology tools of this era is that we could be doing fast Amateur Radio data communications in our most popular VHF / UHF band - 2 meters - 144-148 MHz by using Frequency Hopping Spread Spectrum (FHSS). Despite that band being "heavily used", a FHSS radio could "hop" on (for example) any one of 80 channels that are 50 kHz wide, pseudo randomly "hopping" on each of those channels for 100 mS or so. There aren't any (commercial, or Amateur Radio) units that can do FHSS on 144-148 MHz… but a Software Defined Radio could easily do that, with software written in the GNU Radio framework. Or, a hybrid approach would be to listen before transmitting, and share a repeater's channel for FHSS because when the repeater isn't operating (most of the time these days for many repeaters), the channel could be used because that is not "interference" with the repeater's operation.

And there's also the sibling of AI, Machine Learning (ML), especially ML that can be embedded in a radio system (as opposed to "ML in the cloud"). ML can be used, for example, to develop a "heat map" of radio communications traffic in one's area and thus know how to opportunistically use various portions of spectrum, at times when it's not otherwise in use. An example is the frequencies of repeaters that are typically only used for scheduled nets. ML is inherent in my idea of using FHSS on 144-148 MHz - an ML element of that system will learn usage patterns and dynamically adapt the hopping pattern.

I'm looking forward to getting help from an AI to write GNU Radio blocks to implement some wild ideas I have about new data communications systems in Amateur Radio, and then initially test them in N8GNJ / Zero Retries Labs.

And then one last tool we in Amateur Radio have that can be applied to interesting new approaches in radio technology:

Apply for an FCC Special Temporary Authority (STA) or a Part 5 Experimental License.

We have no shortage of interesting, capable tools to apply to interesting situations in Amateur Radio.

Leave a comment

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ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

APRS101.pdf is Obsolete

John Langner WB2OSZ on the **How APRS Works** blog:

> APRS101.pdf was the APRS protocol reference written in 2000. It is missing decades of corrections, clarifications, and new features.
>
> Implementing a product from this is likely to produce something incompatible with contemporary practices.
>
> …
>
> The tedious work of merging it all together has been done here: https://github.com/wb2osz/aprsspec.
>
> - APRS12b.pdf is version 1.2 draft B.
> - APRS12c.pdf is version 1.2 draft C.
> - etc.
> - APRS-Digipeater-Algorithm.pdf
>
> Your feedback is welcome.

I am very glad to see the hard work that WB2OSZ has done on this project has "become more public". I viewed such work as being one of the primary responsibilities of the APRS Foundation, and promoted that viewpoint in private communications, but that perspective was met with pushback. Or perhaps such work should have been the work of TAPR, given that they are the custodian of the APRS trademark (and thus benefit financially from widespread use of APRS).

In any case, I'm glad to see that WB2OSZ has now decided to create and publicize an up to date APRS specification. WB2OSZ deserves our collective Thanks for doing this tedious, but vital work. In many ways, APRS is one of the primary technologies of modern Amateur Radio, and this up to date APRS specification was badly needed.

# # #

Father's Day Down the Rabbit Hole (Weather Radiosondes)

Mitchell Hamm N8XS on the ke9v.net blog:

> In March of 2023, I saw a new rabbit hole that I almost slipped down. My ham club was invited to the National Weather Service station in Wilmington, Ohio and it was a very memorable and worthwhile trip. We learned how they sample the atmosphere with weather balloons launched twice daily and use the data to feed

> complex models that predict our weather.
>
> …
>
> These little marvels are made by Graw Radiosondes GmbH & Co. in Nuremberg Germany and pack a lot of tech into their 35 grams. Inside they have a transmitter set for the 400-406 MHz range, a ROBLOX GPS chip, two batteries supplying 3.3V DC, and a ribbon header that connects to a sensor pack including a thermistor and humidity sensing element for taking measurements throughout the flight. Hanging off the board is a 180mm wire antenna which is 1/4 wavelength of the transmit frequency. They are encased in Styrofoam to protect the batteries from the -80 F (-62 C) temperatures at 20 miles above the earth.

This is a great overview of the process, and technology of deploying weather balloon radiosondes by the United States Weather Service (USWS). There's also some discussion that the USWS radiosondes can be recovered and repurposed for use in Amateur Radio. I'm old enough to remember when radiosondes were expensive technology and when they were recovered there were instructions on them on how to return them to USWS (postage paid, if I recall correctly).

# # #

TE Systems RF Power Amplifiers for Amateur Radio

TE Systems does not advertise in Amateur Radio media (that I'm aware of) thus I was unaware of their products. They make specific product lines of RF power amplifiers for Amateur Radio VHF / UHF bands:

> Ham/Amateur RF Amplifiers-Ham/Amateur
>
> VHPA Amps-Ham/Amateur (Very High Power Amplifiers)
>
> Repeater Amps-Ham/Amateur
>
> RX Preamps

Good to know that this wide range of power amplifiers are available for Amateur Radio VHF / UHF bands.

# # #

Rig Support for 9600 BAUD Packet

Kevin Wood G7BCS on the Online Amateur Radio Community Wiki:

> I've been on a bit of a journey trying to get 9600 BAUD packet working, especially with off-the-shelf commercial rigs allegedly 9k6 packet capable via their "data" connector. This has been resolved, for me, thanks to Tom M0LTE, who sourced a Tait radio which "just worked". Such radios are hard to find and costly, however,

> so I feel that, if we can better understand the problems with commercial rigs on 9k6 packet, we can increase uptake of this mode and speed our packet network up considerably.
>
> 9600 BAUD packet, whether using the legacy G3RUH mode or IL2P, uses direct FSK modulation of the carrier as opposed to the more usual 1200 BAUD AFSK modulation whereby audio tones transmitted by the radio are modulated in frequency. The upshot of this is that the audio path through both transmitter and receiver needs to be pretty much flat from almost DC to at least the maximum modulating frequency of 4800Hz, and probably beyond this to around 6 KHz, to work well. It's no longer just carrying the 1200 or 2200 Hz AFSK tones but the complete spectrum resulting from the FSK modulating waveform. This isn't going to work via the rig's usual audio signal path, which will be band limited to 300Hz - 3kHz and include some pre-emphasis and de-emphasis.
>
> …
>
> The three rigs I tested were the Tait TM8200, an Icom IC-E208 and a Yaesu FT-7800. The latter two had both failed to perform at 9k6. The former is well proven to work flawlessly.

G7BCS provides an excellent methodology of how to test for "truly usable for 9600", far beyond what I had intended with my imagined "Interoperability testing" in N8GNJ / Zero Retries Labs.

Unfortunately, most of his work may well be wasted in the goal of making 9600 bps used more widely because radios such as the Tait TM8200 are hard to come by. They're sold for commercial use, thus buying them new for Amateur Radio use is expensive (if even possible). Finding them available as surplus is "once in a while you find one", not to mention their condition as surplus is "*sold as is*".

As much as I used to love 9600… I have collected *numerous* TNCs, modems, and radios that are "capable" of "9600 bps"… collectively, generally, trying to do 9600 is, in my observations after decades of using it and playing with it, just a bag of hurt. Sometimes you can make it work, but often you *can't* because of various incompatibilities. The only ways I've observed that 9600 bps can be made to interoperate reliably are:

- Using (essentially) identical radio / modem / adjustments combination. This is most easily achieved with the Kenwood TM-D700 and TM-D710 radios where the 9600 TNC / modem is integrated with the radio, so all the settings, especially deviation, are the same with all units attempting to communicate.

- Using a 9600 bps relay unit (repeater, or digipeater - ugh!) with bit regeneration such as was used in the Puget Sound Amateur Radio TCP/IP Network. In this approach, all the user radios are configured ("tweaked") to the same standard - same deviation, etc. to work with the relay unit. If your radio / modem combination works with the relay unit, then you can communicate effectively with all the *other* users of the relay unit.

- Point to Point links such as advocated by Terrestrial Amateur Radio Packet Networks

(TARPN). In TAPRN's approach, all communications are done with Point to Point links so the two end points can be "tuned" specifically for the two radio / modems in the link. This makes getting "9600" working pretty simple and robust.

Another approach for getting 9600 bps to work reliably, and interoperable, is theoretical (as far as I know, for use with packet radio) - adaptive modulation. Adaptive modulation tunes various parameters for each communication "on the fly". We know this approach works - it was the basis of dial up modems in the early Internet era when the two landline modems would "handshake" and adjust parameters based on the quality of the connection and each modem's capabilities, etc. In Amateur Radio, adaptive modulation has been demonstrated by VARA FM (which is a unique data communications mode, not interoperable with Amateur Radio packet radio).

A modification of this approach might be embedded Machine Learning (ML) where a radio communicates individually with each radio on a channel and determines the optimum parameters for reliable communication with each radio. It then stores those parameters, and when communicating with Radio X, it loads the stored parameters for Radio X and communicates optimally.

I think VARA FM has evolved the use of adapted voice radios (those few that provide an easy to access flat audio connection) about as much as possible. While VARA FM has issues - Windows only, proprietary, etc., there's some hope for an alternative to VARA FM that's open source and potentially may work as well as VARA FM - Mercury modem software by Rhyzomatica. It's early days for using Mercury on Amateur Radio, but from my early observations, it looks hopeful.

# # #

ARRL Teachers Institute – Multiplying the Message

ARRL News and website:

> The educators traveled from all over the country to attend and learn how to take radio and wireless technology back into the classroom as part of science, technology, engineering, and mathematics (STEM) lessons. Many of the teachers took and passed their amateur radio license exams during the week, including Professor Charnell Long, Ph.D. She is a professor at North Carolina A&T University who works with pre-service educators to become certified teachers. She hopes to be a multiplying force for the information.
>
> …
>
> Professor Long is one microcosm of ARRL's focus on multiplying the reach of TI's impact. The ARRL Board of Directors voted unanimously in July 2024 to authorize taking the high-quality education of TI to communities around the country. Increasing the number of teachers and therefore students reached by the training is one peg in the mission to inspire the next generation of radio amateurs.

Kudos to ARRL for scaling up the Teacher's Institute program. I was skeptical when the TI

program was launched that it could make a meaningful impact with one session per year of only a few educators. But TI has been scaled up to now have meaningful impact with more sessions and thus more educators being trained. While I wish that the TI curriculum would include some data communications (beyond the peripheral use of APRS), there's only so much time and I have to admit that balloons and other "cool stuff" that's demonstrated will be interesting to young students.

# # #

Random Serendipity (Universal Radio Hacker)

Onno Benschop VK6FLAB on his Foundations of Amateur Radio podcast:

> The second search result was something called "Universal Radio Hacker". I clicked on the link and discovered a mind boggling tool. There are times in your life when something flips, this was one of those times. It happened when I discovered "csdr" by Andras HA7ILM and again when I discovered "GNU Radio".
>
> Diving into "Universal Radio Hacker", by Dr. Johannes Pohl and Dr. Andreas Noack I was introduced to the art of decoding and generating digital radio signals. In 2018 it was presented for the first time during the USENIX Workshop on Offensive Technologies, or WOOT, as a tool to discover, decode and identify exploits of proprietary IoT devices scattered all over the planet. As an aside, USENIX, Users Of Unix, since 1975.
>
> Back to radio. Universal Radio Hacker allows you to dissect recorded radio signals using all manner of interactive processes. When you go looking for it, and you should, I recommend that you start by watching some videos. You'll find an introductory play list on my YouTube channel. By the time you've seen those, you'll likely share my excitement.

Yet another fascinating tool for us to use in developing (and understanding) better radio technology in Amateur Radio!

# # #

QRP Labs Implemented Polar Modulation

John Simmons NI0K in a comment on Zero Retries 0205:

> Are you aware QRP Labs was selling the QMX+ at Hamvention that is NOW RUNNING POLAR MODULATION? Hans developed his own code.

Relevant background from QRP Labs (Hans Summers G0UPL):

> **Polar Modulation SSB background**
>
> Conventional SSB exciters have an SSB modulator (whether done in analog

> circuits or using SDR techniques) followed by a linear driver amplifier and a linear power amplifier. The linearity is critical to the performance; non-linearities cause intermodulation products which produce close-in spurious products outside the desired SSB passband, causing interference to other spectrum users (known as "Splatter"). The design of the amplifiers needs a lot of care and attention, and the problem is multiplied when a multi-band unit is targeted. It is difficult to achieve good linearity. 1
>
> In 1952 Kahn proposed in an IEEE paper, an SSB generation method called EER (Envelope Elimination and Restoration). You can download his paper here. In his paper Kahn describes splitting the SSB process into phase and amplitude components. Phase modulation and amplitude modulation are applied separately. The phase modulated signal is amplified to full power by a non-linear RF amplifier (such as Class-C); then an amplitude modulator is applied to the supply of the RF amplifier to effect the amplitude modulation. The main benefit of this approach is higher performance because RF amplifier linearity ceases to be an issue. Much is made subsequently of the higher efficiency of such amplifiers but it should be noted that obtaining higher efficiency would require high efficiency amplitude modulation also (perhaps using PWM switching techniques).

This was an idea that was *first proposed 73 years ago???* Now finally implemented in Amateur Radio, on modest hardware?

Technological Innovation in Amateur Radio!

Leave a comment

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Comments Summary From Previous Issue

Comments from Zero Retries 0206:

- Discussion about arranging M17 QSOs (pre-arranged conversations).
- Technological innovation and development is important, but to get an idea / project / technology to actually get used, it has to be promoted.
- Question about RADE.
- More discussion about VP-Digi.
- “Hardening” Raspberry Pi computers… or not.

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My ongoing ***Thanks*** to:
Tina Stroh KD7WSF for, well, *everything!*
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Shreky Stroh, Late Night Assistant Editor In training

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Keywords for this Issue

Zero Retries 0207 dated 2025-06-20:

9600 baud, 9600 bps, **Amateur Radio**, **Data Communications**, **Digital Communications**, Digital Mobile Radio, **Digital Voice**, DMR, **DV**, **Ham Radio**, **N8GNJ**, **Packet Radio**, polar modulation, **Radio Technology**, radiosonde, Repeater, SFR, Simplex Repeater, Single Frequency Repeater, **Software Defined Radio**, **Software Defined Receiver**, **Steve Stroh**, TDD, Time Division Duplex, Universal Radio Hacker

*Keywords in **Bold** are regular mentions in each issue.*

Footnotes for this Issue

To see the relevant sentence for the footnote, just click the footnote number.

1

RedWire Technologies was a refreshing discovery within the high performance Software Defined Radio industry. Most such units are designed for laboratory use with continuously attached computers, and even servers. RedWire has a refreshingly different approach - see Our Approach to Software Defined Radio. In my opinion, RedWire has the right approach for Amateur Radio SDR - create the software, embed it, and then *use it like a radio*.

2

But not entirely ridiculously expensive within Amateur Radio. For example, the new cost of a FlexRadio AU-520M is ***$9600***.

3

My absolute favorite example of "digital technology simultaneously improves in capability and reduced cost over time" is a comparison of Cray Supercomputers versus Raspberry Pi computers.

4

In my lifetime, in my experience with Amateur Radio club newsletters, I think this "it has to be *short*" traces back to paper newsletters being distributed by postal mail. Newsletters were kept pretty short, short, just a few pages or so, to keep the weight of the newsletter under a few ounces, and thus could be mailed via for a modest amount of postage, to keep the individual subscription price low. If you had something lengthy to convey, *that's for magazines*.